in brickearth. Forty implements and numerous chipped fragments have been found, and the position of certain well wrought oval implements, in and under compact clay at the lowest levels, identifies them as missiles hurled at water-fowl on the lake. Teeth of elephant, rhinoceros, ox, and deer occur in coarse gravel below the implement layer, and plant-roots in the clay below that.

Prof. E. B. Poulton exhibited records of Palæolithic man from a new locality on the north-east coast of the Isle of Wight, including every stage from flake to finished implement.

The sixth report of the committee on the lake village at Glastonbury announced fresh excavation in 1904, under the joint superintendence of Mr. A. Bulleid and Mr. H. St. G. Gray. Eight mounds, containing two or more floors, were examined, and plans and photographs secured. Objects of amber, glass, and tin, and an adze of iron were found, as well as bronze, stone, and bone objects, and pottery. In one mound, peas were found in some quantity. Arrangements are in progress for the publication of the results of the whole excavation.

Mr. F. R. Coles and Dr. T. H. Bryce described an interment of the early Iron age found at Moredun, near Edinburgh, in 1903. A cist covered with flagstones contained fragmentary human remains of normal local type, with a fibula of La Tène type, a ring-brooch, and a circular open pinhead, indicating a date not later than the second century A.D. This is the first completely attested interment of early Iron age in Scotland.

Dr. T. H. Bryce discussed a phase of transition between the chambered cairns and closed cists in the south-west corner of Scotland. The clue is given by a cairn at Glecknabae, in Bute, which contained two "atypical" chambers set radially in the cairn and containing burnt bones, and a closed cist with unburnt interment. One of the chambers also contained an unburnt fragment. The pottery, which included both typical "chamber" pottery and also fragments of the "beaker" class, indicated a triple occupation of the site, and a late date for the reduced atypical chamber.

The report of the Roman sites committee described work in progress at Silchester and Caerwent, and Mr. T. Ashby summarised the season's progress on the latter site. The south gate has been found to be parallel to the gate on the other side, and an inscription dedicated to Mars bears the date August 23, 152 A.D.

Prof. Flinders Petrie's excavations at Ehnasya have been already mentioned in connection with his series of Roman lamps. Ehnasya is the Roman Herakleopolis Magna and the Egyptian Henensuten, about 70 miles south of Cairo and 10 miles from the Nile. It was the home of the ninth and tenth dynasties, of which hardly anything is known. It is found to contain temples of the eighteenth and twelfth dynasties, and under the latter a stratum of older houses and burials with scarabs of Antef V. This king has recently been assigned to dynasty XVI. or XVII., but is thus brought earlier than dynasty XII. Later buildings of dynasty XXIII. yielded a fine votive statuette, in gold, of the local ram-headed deity, Hershefia, dedicated by a vassal of King Piankhi; and houses of Roman date gave important evidence as to the stages by which Christianity first displaced the native animal-cults, and then itself absorbed the Isis and Horus worship as the Madonna-cult.

Mr. J. Garstang described his excavations in the Royal tomb of Negadeh, in Upper Egypt, which completed the work begun some years back by the French, and recovered another fragment of the "Tablet of Mena," to whom the tomb has been commonly attributed.

Mr. R. N. Hall's recent excavations at Great Zimbabwe show the ruins to be three times larger than was supposed, and distinguish clearly between (*a*) the original constructions (*e.g.* the eastern half of the "Elliptical Temple"), which are still of uncertain age and associated with numerous phalli, and (*b*) sundry additions which are shown by Arab pottery to be not older than about 1300 A.D., and do not contain phallic objects. Much useful work has been done on behalf of the Chartered Company to preserve existing structures, and to clear the ruins of surface deposits and other obstacles to study.

BOTANY AT THE BRITISH ASSOCIATION.

The meeting of the botanical section at Cambridge may probably be regarded as the most successful of the whole series of meetings which have been held since botany was constituted a separate section of the British Association. A large number of distinguished foreign botanists were present, and there was a fully representative gathering of British botanists to meet them. By the kindness of Prof. H. Marshall Ward, F.R.S., the meetings were held in the rooms of the new botany school, which proved to be admirably suited for the purpose. Prof. Ward and the botanical staff are to be congratulated upon the excellent arrangements made for the lectures, lantern demonstrations, exhibition of apparatus and specimens, &c., which contributed so much to make the meeting a success.

The president (Mr. Francis Darwin, F.R.S.) in his address, which has already appeared in Nature (September 8), dealt with the perception of the force of gravity by plants, and especially with the statolith theory of geotropism.

The general work of the section included, in addition to the more technical papers, the usual semi-popular lecture, and a series of three addresses of a general character on important topics.

The subject of the semi-popular lecture, which was delivered by Dr. D. H. Scott, F.R.S., was a new aspect of the Carboniferous flora. It was shown that Brongniart's conception of the Carboniferous period as the reign of Cryptogams can no longer be maintained. Recent work has all tended to show that a large number—perhaps the majority—of the so-called ferns of that period were not true ferns at all, but seed-bearing plants approaching the Cycadophyta. While their affinity with ferns is evident, these plants had already acquired spermatophytic methods of reproduction—hence the name Pteridospermeæ is proposed for them. If we further take into account the seed-plants previously known—notably the Cordaiteæ—and those Lycopods which produced organs analogous to seeds, we are led to the conclusion that quite half the vascular plants of the Carboniferous period had already assumed the seed-habit.

Ecology.

Prof. A. G. Tansley, in an address on the problems of ecology, defined ecology for his purpose as the study of those relations of plants to their environment dependent on geographical and topographical factors. It is very largely topographical aggregates, due to soil, water, and other conditions with which ecology has to do, and the study of these falls into two parts, descriptive and experimental. The problems to be solved may be indicated during the progress of an ordinary botanical survey, but it requires the establishment of experimental stations in regions characterised by definite and specialised floras in order that the detailed investigation of the functional relations of plants to their surroundings may be more completely carried out.

Dr. W. G. Smith, whose work in connection with the botanical surveys of the north of England is so well known, in referring to the ecological aspect of the British flora, pointed out that a general survey of the chief plant associations of Britain has so far revealed some broad principles of distribution in relation to soil and climate, and that when wider areas are investigated the chief plant associations may be more clearly defined as climatic, edaphic, or biological formations.

Mr. T. W. Woodhead gave an interesting account of his observations on the biology and distribution of woodland plants, and dealt with some of the principal factors, such as shade, soil, &c., which tend to modify the plant associations under trees.

Prof. A. Engler (Berlin) read a paper on the plants of the northern temperate zone in their transition to the high mountains of tropical Africa, in which he pointed out that the differences seen in most of the highland forms of plants of tropical Africa, as compared with their relatives of the northern temperate zone, are always in harmony with the different climatic conditions. The modifications observed may be regarded as adaptations, but only in the sense that the adaptation is a passive one caused by the physical conditions of the climate, not an active one corresponding to the views of the Lamarckians.

Mr. Francis J. Lewis presented a paper on the inter-Glacial and post-Glacial beds of the Cross Fell district, in which he pointed out that the plant remains are of considerable interest as throwing light upon the duration and climatic conditions of the several Glacial and inter-Glacial periods. The plant remains of the post-Glacial peat also show that considerable fluctuations have taken place in climate since the close of the Glacial period.

Morphology (including Palaeobotany).

Dr. D. H. Scott, F.R.S., described a new type of sphenophyllaceous cone from the Lower Coal-measures; the cone shows the anatomy and general organisation characteristic of the group, but is distinguished by its branched sporangiophores terminating in peltate, bisporangiate scales, and by the absence of any sterile appendages.

In conjunction with Mr. E. A. Newell Arber, Dr. Scott also presented a short account of two new Lagenostomas. In one of them, *L. Kidstoni,* the seeds are naked, but in the other, *L. Sinclari,* there are indications of an external envelope or cupule. The new seeds were apparently borne on the ultimate branches of a frond in which the lamina had been greatly reduced. There are indications that the fronds were of the Sphenopteris type.

Prof. C. Eg. Bertrand (Lille) contributed a paper by Prof. Cornaille and himself on "La structure de la trace foliaire des Filicinées inversicatenates."

Miss Sibille O. Ford gave an account of the anatomy of *Psilotum triquetrum,* from which she concludes that the Psilotaceæ not only present an affinity with the fossil Sphenophyllales, but also have a strong resemblance, anatomically, to some of the fossil Lycopods, especially to the stem of *Lepidodendron mundum,* as well as to the axis of the cone of *Lepidostrobus Brownii.*

Mr. T. G. Hill, in a paper on the presence of parichnos in recent plants, pointed out that in the mature sporophyll of *Isoetes Hystrix* in the lateral expansions of its base are two longitudinal mucilage-containing cavities which arise by the mucilaginous degeneration of two strands of parenchyma. He suggests that this represents the parichnos occurring in Lepidodendron, Sigillaria, Lepidocarpon, &c.

Dr. Marie G. Stopes described her recent observations on some new points observed in the ovular anatomy and structure in the different genera of Cycads, with the conclusion that there are well marked indications of two integuments.

Mr. L. A. Boodle read a paper on the reduction of the gametophyte in *Todea Fraseri.* Owing to delay in the dehiscence of the sporangium under certain conditions, many of the spores germinate within it. The prothallus may consist of only two or three cells with an antheridium. This is of special interest when compared with the microspores of Salvinia, as illustrating how a reduction of the thallus of a fern approaching that shown by Salvinia may be brought about by the non-dehiscence of the sporangium.

Dr. William H. Lang, in a paper on the reduction of the marchantiaceous type in Cyathodium, concludes that it appears probable that Cyathodium has been derived by adaptation to damp and ill lighted situations from a well characterised marchantiaceous form of about the same grade of differentiation as Targionia.

Dr. J. P. Lotsy (Leyden), in an interesting account of the virgin woods of Java, discussed the modifications produced in the vegetation by the two great forces moisture and light, and proposed the use of a new term, biaiomorphose, indicating that the form of each individual plant is not a form innate to that plant, but is the result of its specific structure and the sum of all external circumstances which have acted upon it.

Mr. E. A. Newell Arber presented a paper on a new feature in the morphology of the fern-like fossil Glossopteris.

Dr. Otto Stapf exhibited and described the fruits of Melocanna, Melocalamus, and Ochlandra.

Mrs. D. H. Scott gave demonstrations of kammatograph photographs showing the opening and closing of flower buds, the visits of insects to flowers, and other interesting records of the movements of plants.

Mr. Alfred P. Maudslay gave an account of some measurements he had made of the great swamp cypress at Santa Maria del Tule, Mexico. The area of a cross section of the trunk of this tree, at a height of 6 feet from the ground, is 408 square feet.

Dr. K. C. Miyake (Tokio) read a paper on the centrosome of the Hepaticæ, from which it appears that it is very doubtful whether centrosomes occur at all in these plants.

Lord Avebury, F.R.S., in a note on the forms of the stems of plants, brought forward the view that the shapes of the stems of plants are dependent upon the arrangements of the leaves, and the consequent distribution of the strengthening tissues in the stem so as to secure the greatest strength with the least expenditure of materials.

A short discussion on the present state of our knowledge of the cell structure of the Cyanophyceæ was opened by Mr. Harold Wager, F.R.S., who pointed out that the central body of the cell must be regarded as a nucleus, but that it is of a simpler or more rudimentary type than the nucleus of the higher plants.

Prof. E. Zacharias (Hamburg), whilst admitting that the central body contains, under certain conditions, that essential constituent of the nucleus, nuclein or chromatin, could not accept the view that it is a nucleus, and especially objected to Kohl's conclusion that it is a true nucleus in which both chromosome and spindle formation can be observed.

Prof. R. Chodat (Geneva) considered that the central body of the Cyanophyceæ is merely a specialised region of the cytoplasm in which granules of reserve substance accumulate, and not of the nature of a nucleus at all.

Mr. E. R. Burdon gave an account of the pineapple galls of the spruce which are caused by the hibernating generation of certain Aphidæ belonging to the genus Chermes.

In the early stages the chlorophyll, tannin, resin, resin canals, and secretory cells of every description disappear within the gall area, which consists entirely of enormously swollen parenchymatous cells. Starch is found in great abundance round the periphery of the gall area, and it is suggested that it may be the ultimate product of the disintegration of the tannin.

The nuclei of the galled cells also become enlarged, and the chromatin network becomes aggregated into numerous wart-like nucleoli. The mitotic figures are of the usual somatic type, and no indication of heterotypical mitoses has yet been found.

Mr. R. T. Baker exhibited specimens illustrating (1) the comparative constancy of specific characters of Eucalyptus, (2) the relation between the leaf venation and the oil constituents.

Prof. R. Chodat exhibited some beautiful examples of pure cultures of algæ, and Prof. G. S. West some photomicrographs of fresh-water plankton.

Physiology.

Dr. F. F. Blackman gave an interesting address on the important investigations which have been carried on by Miss Matthaei and himself on the question of sunshine and carbon-dioxide assimilation. The address was illustrated by a series of experiments, and the numerous elaborate and ingenious pieces of apparatus which have been devised by the authors for the automatic recording of the complicated data required were exhibited and explained.

Prof. S. H. Vines, F.R.S., gave an account of his researches on the proteases of plants, the general occurrence of which he has demonstrated in all parts of plants. They are not of the nature of pepsin, but correspond rather to either the trypsin or the erepsin of the animal body. Trypsin and erepsin differ from each other in their capacity for peptonising the higher proteids. Thus trypsin can peptonise so complex a proteid as fibrin, whereas erepsin cannot, though it can peptonise casein. It has been found that in certain cases the juices or extracts of plants can peptonise fibrin, indicating the presence of a tryptic protease; but more commonly they do not possess this capacity.

Prof. L. Errera (Brussels), in a paper on the localisation of alkaloids in plants, pointed out that, although the physiology of alkaloids is far from settled, a critical study of their topography, as well as their behaviour in germination, growth, etiolation, maturation of seeds, &c., supports the view that they are waste-products, resulting from the catabolism of cytoplasm, and secondarily utilised for defence against animals. A few grams of an alkaloid constitute a protection not less efficient than the strongest spines.

Prof. Errera also read a paper on the struggle for pre-eminence and inhibitory stimuli in plants, and Dr. J. P. Lotsy (Leyden) gave an account of his discovery of a new alkaloid in *Strychnos nux-vomica.*

Important papers were also read by Prof. R. Chodat (Geneva), on oxidising enzymes and katalases in plants; by Prof. G. Klebs (Halle), on the artificial formation of a new race; by Prof. F. Czapek (Prague), on the importance of the anti-ferment test in geotropically stimulated roots; by Prof. K. Fujii (Tokio), on the pollination of Gymnosperms; and by Dr. G. J. Peirce (California), on the dissemination and germination of *Arceuthobium occidentale.*

Mr. J. Parkin gave an experimental demonstration of a brilliant pigment appearing after injury in species of Jacobinia, the shoots of which when bruised and extracted with water yield a beautiful purplish liquid. Such a reducing agent as stannous chloride decolorises it. Micro-organisms can also readily bleach it when oxygen is excluded, but on allowing air to enter the original colour at once returns. The whole phenomenon bears some resemblance to the way in which indigo arises in plant-tissues.

Papers were also contributed by Dr. Otto V. Darbishire on the transpiration stream in small plants, and by Dr. George Barger on saponarine (soluble starch).

Fungi.

Prof. H. Marshall Ward, F.R.S., gave an address on recent researches in parasitic fungi. The investigations of De Bary and others were shortly described, and then Prof. Ward described his own experimental work on the determination of the external conditions necessary for the germination of the spores of fungi. He showed that a knowledge of the germinating capacity of the spores is necessary in order to arrive at definite conclusions as to the immunity of new varieties of cereals from disease. In opposition to Prof. Eriksson, he maintained that there is no evidence to show that fungus diseases are spread in any other way than by spores, and that his experimental and microscopic investigations do not in any way support Eriksson's mycoplasm theory.

Prof. Eriksson (Stockholm), in a paper on the vegetative life of some Uredineæ, dealt in considerable detail with this question, and sought to show that the evidence before us as to the infection of cereals by the disease could only be explained by the presence of mycoplasm in the seed.

Mr. V. H. Blackman and Miss Helen C. I. Fraser gave an account of the development of the æcidium of *Uromyces poae* and the life-history of *Puccinia malvacearum,* in which many new facts were brought forward, especially concerning the sexual fusion of nuclei in the æcidial cells.

Mr. E. S. Salmon described some further cultural experiments with biologic forms of the Erysiphaceæ which demonstrate the fact that the infection-powers of a "biologic form" are not altered by its residence for one generation on a strange host-plant, and give also some evidence in favour of the idea of the hereditary nature of the infection-powers of certain "biologic forms."

Mr. R. H. Biffen, in a paper on the inheritance of susceptibility to and immunity from the attacks of yellow rust, brought forward evidence to show that the liability to certain diseases is inherited, and from the results of crossing together races of wheat relatively immune from and highly susceptible to the attacks of *Puccinia glumarum,* it appears that susceptibility is dominant over immunity in the hybrid.

Miss C. M. Gibson gave an account of her infection experiments with various Uredineæ, which show that the germ tubes from the spores of any uredine may enter almost any plant, and that the attractive substance causing entry is not specialised in each species, but is something common to all plants.

Dr. A. H. Reginald Buller presented papers on the destruction of wooden paving blocks by the fungus *Lentinus lepideus,* Fr., and the reactions of the fruit-bodies of *Lentinus lepideus,* Fr., to external stimuli; and Mr. B. T. P. Barker on the structure of the ascocarp in the genus Monascus, and on some further observations on the ascocarp of Ryparobius.

Dr. A. F. Blakeslee (U.S.A.) briefly described his investigations on the sexuality of zygospore formation. According to their method of zygospore formation the Mucorineæ may be divided into homothallic and heterothallic forms. In the first group zygospores are developed from branches of the same thallus. In the second group, comprising probably a majority of the species, the zygospores are developed from branches which belong to thalli diverse in character. The sexual strains in an individual species show a more or less marked difference in vegetative luxuriance. The author concludes that the mycelium of the homothallic species is bisexual, whilst that of the heterothallic species is unisexual.

In the agricultural subsection, which met under the presidency of Prof. W. Somerville, the following papers were read:—improvement of wheats and Mendel's laws, R. H. Biffen; hybridisation of cereals, Dr. J. H. Wilson; the clover mystery: a probable solution of it, R. H. Elliott; analysis of soil by the plant, and the probable error of agricultural field experiments, A. D. Hall; determination of available phosphates, T. S. Dymond and G. Clark; sulphates in their relation to growth of crops, T. S. Dymond and F. Hughes; the improvement of clay pastures by leguminous plants, Prof. T. H. Middleton; formation of ammonia, nitrites, and nitrates, Dr. E. J. Russell; chemical composition of mangels, and variation in mangels, T. B. Wood and R. A. Berry. Prof. W. D. Atwater (Middletown, Conn., U.S.A.), who was present at the meeting, also communicated a paper to the section.

EDUCATION AT THE BRITISH ASSOCIATION.

After the president's address (published in Nature of September 15), the first paper on the programme was on the present educational position of logic and psychology, by Miss E. E. C. Jones, in which attention was directed to the fact that, on the one hand, logical and psychological studies hold a position of growing importance in English thought and education, while, on the other hand, the quality and organisation of the instruction supplied leave much to be desired. Some logic and psychology are now required for teachers' training examinations; it is also desirable that all students of religious doctrine or of the great questions of philosophy should be equipped with logical method and psychological knowledge.

The section listened with interest to the lucid account of the advances made in the teaching of experimental science in the secondary schools of Ireland given by the Right Rev. Gerald Molloy. The result of three years' work is splendid, thanks to a cordial and remarkable cooperation of teachers, of schools, and of local authorities with the Intermediate Education Board and the Department of Agriculture and Technical Instruction. These latter bodies have adopted a common programme in science subjects, and are carrying out a common system of examination and inspection. All the secondary schools of the country, about 250 in number, are enjoying the benefits due to judicious introduction of practical work in the laboratory, and the administrators may justly be congratulated on the fact that there are more than 9000 pupils following the preliminary course, and 1500 pursuing a more specialised course after passing through the preliminary. The manner in which the first great difficulty, that of providing competent teachers, was overcome is interesting, but it is of more importance now to note that the organisers took the right road to efficiency by putting men first and bricks and mortar second. (Might not some of our local authorities and governing bodies in England receive a useful hint?) For the future "the Department propose to grant the 'Irish Teacher's Science Certificate' to all students who pass through a three years' course, prescribed for the purpose, in the Royal College of Science, Dublin. They will also recognise as qualified teachers students who have followed a similar course in any university or technical college, and who have obtained the corresponding degree or diploma."

The discussion was mainly congratulatory, but one criticism deserves, and will no doubt receive, careful consideration from the authorities. It was felt by many that among subjects relegated to the optional courses were some of such fundamental importance as to be an indispensable part of an all-round education. This, of course, is part of the wide and difficult problem which is getting more and more pressing, viz. what can be safely *left out* of the secondary school curriculum? It is safe to reply to Dr.